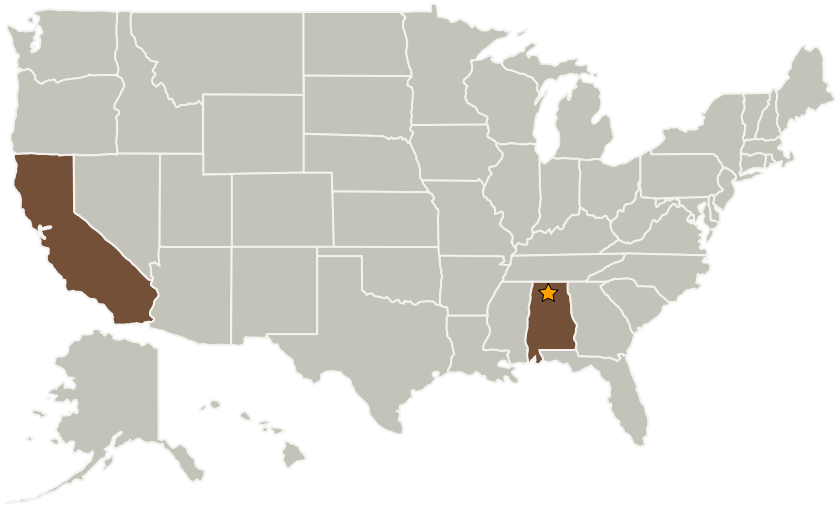
Time-stepped & discrete-event simulations of electromagnetic propulsion systems, Phase II

Completed Technology Project (2002 - 2002)

Project Introduction

The existing plasma codes are ill suited for modeling of mixed resolution problems, such as the plasma sail, where the system under study comprises subsystems with diverse modeling paradigms (e.g., fluid, kinetic) at differing levels of temporal and spatial resolution. Such complex systems are not unique to propulsion studies, but are commonly encountered in wide variety of fields. In Phase I, we were able to develop and successfully test the core technology for multi-resolution modeling within two distinct computational paradigms. By introducing a temporal mesh, we successfully overcame a major obstacle in the use of time-stepped simulations for multi-resolution problems. However, even more significant is our finding that discrete event simulation methodology works quite well for many-body systems such as plasmas with several orders of magnitude performance advantage over equivalent time-stepped simulations. The importance of this result cannot be overstated as it will have immediate repercussions in all fields where time-stepped modeling are currently used. Using these early versions of our code, we were able to address a number of outstanding issues in regards to the feasibility of plasma sails. Our objectives for Phase II are (i) to fully develop the codes, (ii) address the issues regarding the feasibility of plasma sails such as expansion of the magnetic bubble by the plasma source and the resulting drop-off of the magnetic field strength with radial distance, and (iii) prepare plans for marketing our technology in Phase III.

Primary U.S. Work Locations and Key Partners



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Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Center / Facility:

Marshall Space Flight Center (MSFC)

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

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Organizations Performing Work	Role	Type	Location
★Marshall Space Flight Center(MSFC)	Lead Organization	NASA Center	Huntsville, Alabama
Scibernet, Inc.	Supporting Organization	Industry	San Diego, California

Primary U.S. Work Locations	
Alabama	California

Project Management

Program Director:
Jason L Kessler

Program Manager:
Carlos Torrez

Project Manager:
Dennis L Gallagher

Principal Investigator:
Homa Karimabadi

Technology Areas

Primary:

- TX11 Software, Modeling, Simulation, and Information Processing
  - TX11.3 Simulation
    - TX11.3.6 Uncertainty Quantification and Nondeterministic Simulation Methods